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It's Important to Know!

BP202T — Pharmaceutical Organic Chemistry I

B.Pharm Semester 2 · Unit 1 — Classification, Nomenclature and Isomerism

Unit I: Classification, Nomenclature and Isomerism

Organic compounds are classified by carbon skeleton and functional group. Open-chain compounds may be straight-chain or branched. Carbocyclic compounds contain rings made of carbon atoms. Aromatic compounds have special cyclic conjugation. Functional groups determine characteristic reactions.

Nomenclature

IUPAC naming selects a parent chain or ring, identifies the principal functional group, numbers the structure to give the lowest possible locant and lists substituents alphabetically. Common names remain important in pharmacy, but the systematic name should be used when precision is needed.

Structural isomerism

Chain isomers differ in carbon skeleton. Position isomers differ in the position of a substituent or functional group. Functional isomers have the same molecular formula but different functional groups. Metamerism can occur when different alkyl groups surround a polyvalent atom. Tautomerism is a dynamic equilibrium between constitutional forms, commonly involving proton transfer and double-bond movement.

Stereoisomerism and representations

Stereoisomers have the same atom-to-atom connectivity but differ in spatial arrangement. Geometrical isomerism can arise when rotation is restricted, as in a double bond or a ring. In a double-bond pair, the higher-priority substituents on the same side are described as Z, and those on opposite sides as E. Cis and trans are useful for simpler cases where the comparison is unambiguous.

An asymmetric carbon is attached to four different substituents and can give non-superimposable mirror-image forms. These are enantiomers. Other stereoisomers that are not mirror images are diastereomers. A racemic mixture contains equal amounts of two enantiomers and has no net optical rotation in an ideal measurement. A compound with stereogenic centres can still be optically inactive if internal symmetry makes it meso.

Worked naming approach

For a simple branched alcohol, first choose the longest chain that contains the carbon bearing the hydroxyl group. Number from the end that gives the hydroxyl group the lowest locant, then identify and alphabetise substituents. For example, a four-carbon chain with the hydroxyl group on carbon two and a methyl substituent on carbon three is named 3-methylbutan-2-ol. This example illustrates parent selection, principal group numbering and substituent placement.

For a molecule containing more than one functional group, the group with higher naming priority is expressed by the suffix and the other group may be named as a prefix. The applicable priority sequence should be checked against the current IUPAC recommendations when less common groups occur.

Isomerism worked examples

Consider compounds with molecular formula C_2H_6O . One has an oxygen between two carbon groups, while the other has a hydroxyl group attached to a carbon chain. They have the same formula but different functional groups, so they are functional isomers. In contrast, two butane arrangements with a continuous chain versus a branched chain are chain isomers. These examples show why a molecular formula alone does not identify a compound.

Unit I: Frequently asked questions

Q: What is a functional group?

A: It is an atom or group of atoms that gives an organic compound characteristic chemical behaviour.

Q: What is chain isomerism?

A: It is structural isomerism caused by different arrangements of the carbon skeleton.

Q: What is the first step in IUPAC naming?

A: Select the parent chain or ring containing the principal functional group and then number it according to the naming rules.

Unit I: Key takeaways

- Classification depends on carbon skeleton and functional group.
- IUPAC naming uses a parent structure, locants and substituent names.
- Chain, position and functional isomerism are structural forms of isomerism.
- Tautomeric forms interconvert through proton and double-bond movement.
- Common names should not replace precise systematic identification.

Unit I: Practical correlation

Practical correlation: identity checking. A compound label, systematic name, molecular formula and analytical result should agree before a material is accepted.